



# DECUS

## PROGRAM LIBRARY

DECUS NO.

8-278

TITLE

SINGLE LENGTH FLOATING POINT PACKAGE

AUTHOR

R.J. Bedding and A.S. Charlesworth

COMPANY

Bath University of Technology  
Claverton Down, Bath, Somerset, England

DATE

Submitted: June 26, 1970

SOURCE LANGUAGE

PAL III

### ATTENTION

This is a USER program. Other than requiring that it conform to submittal and review standards, no quality control has been imposed upon this program by DECUS.

The DECUS Program Library is a clearing house only; it does not generate or test programs. No warranty, express or implied, is made by the contributor, Digital Equipment Computer Users Society or Digital Equipment Corporation as to the accuracy or functioning of the program or related material, and no responsibility is assumed by these parties in connection therewith.

200000

200000



200000

200000

200000

200000

200000

200000

200000

200000

200000



# SINGLE LENGTH FLOATING POINT PACKAGE

DECUS Program Library Write-up

DECUS No. 8-278

## ABSTRACT

This Single Length Floating Point Package consists of a modified version of DEC-08-YQ1A-PB and is intended as an alternative where input and output accuracy is adequately served by single length working. Entry points and commands are identical with the standard double length version.

Increased speed of calculation is its merit for the program was developed for on-line calculations employing ADC's and DAC's. Typical improvements in execution time are listed below:

	SINGLE LENGTH	DOUBLE LENGTH
FADD	1.2	2.4
FSUB	2.0	3.25
FMPY	0.4	4.00
FDIV	2.25	4.4
FSQT	3.6	13.5



/FLOATING POINT ARITHMETIC INTERPRETER  
\*40

0040	0000	EX1,	0
0041	0000	AC1H,	0
0042	0000	AC1L,	0
0043	0000	OVER1,	0
0044	0000	EXP,	0
0045	0000	HORD,	0
0046	0000	LORD,	0
0047	0000	OVER2,	0
0050	0000	EXP1,	0
0051	0000	QUOL,	0
0052	0000	FPAC1,	0
0053	0000		0
0054	0000		0

\*61

0061	0000	FLAG,	0
------	------	-------	---

\*5600

/ ARITHMETIC ERROR FLAG

FPNT,	0
-------	---

5600	0000		
5601	7300	CLA CLL	
5602	3042	DCA AC1L	
5603	3046	DCA LORD	
5604	1600	TAD I FPNT	
5605	3250	DCA JUMP	
5606	1250	TAD JUMP	
5607	0260	AND PAGENO	
5610	7650	SNA CLA	
5611	5214	JMP .+3	
5612	1256	TAD MASK5	
5613	0200	AND FPNT	
5614	3253	DCA ADDR	
5615	1257	TAD MASK7	
5616	0250	AND JUMP	
5617	1253	TAD ADDR	
5620	3253	DCA ADDR	
5621	1261	TAD INDRCT	
5622	0250	AND JUMP	
5623	7650	SNA CLA	
5624	5227	JMP LOOP01	
5625	1653	TAD I ADDR	
5626	3253	DCA ADDR	
5627	2200	ISZ FPNT	
5630	1653	TAD I ADDR	
5631	3040	DCA EX1	
5632	1253	TAD ADDR	
5633	3254	DCA SAVE	
5634	2254	ISZ SAVE	
5635	1654	TAD I SAVE	
5636	3041	DCA AC1H	
5637	1250	TAD JUMP	
5640	7106	CLL RTL	
5641	7006	RTL	

/ GET NEXT INSTRUCTION

/ PAGE ZERO  
/ YES

LOOP01,





5642	0255		AND MASK3	/ GET THE OP CODE
5643	1262		TAD TABLE	
5644	3251		DCA JUMP2	
5645	1651		TAD I JUMP2	
5646	3251		DCA JUMP2	
5647	5651		JMP I JUMP2	
5650	0000	JUMP,	0	
5651	0000	JUMP2,	0	
5652	0000	GO2,	0	
5653	0000	ADDR,	0	
5654	0000	SAVE,	0	
5655	0017	MASK3,	0017	
5656	7600	MASK5,	7600	
5657	0177	MASK7,	0177	
5660	0200	PAGENO,	0200	
5661	0400	INDRCT,	0400	
5662	5663	TABLE,	+.1	
5663	5726		EXIT	
5664	5706		FLAD	
5665	5723		FLSU	
5666	5745		FLMY	
5667	6240		FLDV	
5670	5673		FLGT	
5671	5700		FLPT	
5672	5757		NORF	
5673	1040	FLGT,	TAD EX1	
5674	3044		DCA EXP	
5675	1041		TAD AC1H	
5676	3045		DCA HORD	
5677	5201		JMP FPNT+1	
5700	1044	FLPT,	TAD EXP	
5701	3653		DCA I ADDR	
5702	2253		ISZ ADDR	
5703	1045		TAD HORD	
5704	3653		DCA I ADDR	
5705	5201		JMP FPNT+1	
5706	4755	FLAD,	JMS I ALGN	
5707	5201		JMP FPNT+1	
5710	4756		JMS I UNORM	
5711	7100		CLL	
5712	1042		TAD AC1L	
5713	1046		TAD LORD	
5714	3046		DCA LORD	
5715	7004		RAL	
5716	1041		TAD AC1H	
5717	1045		TAD HORD	
5720	3045		DCA HORD	
5721	4754		JMS I NORM	
5722	5201		JMP FPNT+1	





5723	4725	FLSU,	JMS I OPMINS
5724	5306		JMP FLAD
5725	6400	OPMINS,	MINUS2
5726	1250	EXIT,	TAD JUMP
5727	0255		AND MASK3
5730	7450		SNA
5731	5600		JMP I FPNT
5732	1344		TAD ACON6
5733	3251		DCA JUMP2
5734	1651		TAD I JUMP2
5735	3251		DCA JUMP2
5736	1200		TAD FPNT
5737	3252		DCA G02
5740	4651		JMS I JUMP2
5741	1252		TAD G02
5742	3200		DCA FPNT
5743	5201		JMP FPNT+1
5744	6516	ACON6,	TABLE6-1
5745	7201	FLMY,	CLA IAC
5746	1040		TAD EX1
5747	1044		TAD EXP
5750	3044		DCA EXP
5751	4753		JMS I MULT
5752	5201		JMP FPNT+1
5753	6216	MULT,	DMULT
5754	6600	NORM,	DNORM
5755	6013	ALGN,	ALIGN
5756	6536	UNORM,	DUNORM
5757	4754	NORF,	JMS I NORM
5760	5201		JMP FPNT+1





6000	0000	*6000	
6001	7300	ACMINS,	Ø
6002	1046		CLL CLA
6003	7041		TAD LORD
6004	3046		CMA IAC
6005	1045		DCA LORD
6006	7040		TAD HORD
6007	7430		CMA
6010	7101		SZL
6011	3045		CLL IAC
6012	5600		DCA HORD
			JMP I ACMINS

/ROUTINE TO PERFORM DOUBLE PREC  
/NEGATION OF FLOATING ACC

6013	0000	ALIGN,	Ø
6014	1045		TAD HORD
6015	7650		SNA CLA
6016	5313		JMP NOHERE
6017	1041		TAD AC1H
6020	7650		SNA CLA
6021	5613		JMP I ALIGN
6022	1040		TAD EX1
6023	7041		CMA IAC
6024	1044		TAD EXP
6025	7450		SNA
6026	5273		JMP DONE
6027	7500		SMA
6030	7041		CIA
6031	3316		DCA AMOUNT
6032	1316		TAD AMOUNT
6033	1317		TAD TEST2
6034	7700		SMA CLA
6035	5243		JMP .+6
6036	4275		JMS OUTGO
6037	7430		SZL
6040	1322		TAD TAG1
6041	1323		TAD TAG2
6042	5304		JMP NOGO
6043	4275		JMS OUTGO
6044	7420		SNL
6045	1323		TAD TAG2
6046	1322		TAD TAG1
6047	3320		DCA TEST3
6050	1316		TAD AMOUNT
6051	7041		CIA
6052	1720		TAD I TEST3
6053	3720		DCA I TEST3
6054	2320		ISZ TEST3
6055	1320		TAD TEST3
6056	3321		DCA TEST4
6057	2321		ISZ TEST4





6060	7100	SHIFT,	CLL
6061	1720		TAD I TEST3
6062	7510		SPA
6063	7020		CML
6064	7010		RAR
6065	3720		DCA I TEST3
6066	1721		TAD I TEST4
6067	7010		RAR
6070	3721		DCA I TEST4
6071	2316		ISZ AMOUNT
6072	5260		JMP SHIFT
6073	2213	DONE,	ISZ ALIGN
6074	5613		JMP I ALIGN
6075	0000	OUTGO,	0
6076	1040		TAD EX1
6077	7041		CIA
6100	1044		TAD EXP
6101	7004		RAL
6102	7200		CLA
6103	5675		JMP I OUTGO
6104	3320	NOGO,	DCA TEST3
6105	1720		TAD I TEST3
6106	3044		DCA EXP
6107	2320		ISZ TEST3
6110	1720		TAD I TEST3
6111	3045		DCA HORD
6112	5613		JMP I ALIGN
6113	1040	NOHERE,	TAD EX1
6114	3044		DCA EXP
6115	5273		JMP DONE
6116	0000	AMOUNT,	0
6117	0014	TEST2,	14
6120	0000	TEST3,	0
6121	0000	TEST4,	0
6122	0044	TAG1,	EXP
6123	7774	TAG2,	EX1-EXP
6124	5601	RETN2,	FPNT+1
6125	1333	ERROR1,	TAD GOOF
6126	3044		DCA EXP
6127	1333		TAD GOOF
6130	3045		DCA HORD
6131	2061		ISZ FLAG
6132	5724		JMP I RETN2
6133	3777	GOOF,	3777
6134	0000	SQUARE,	0
6135	4407		JMS I 7
6136	6052		FPUT FPAC1
6137	3052		FMPY FPAC1
6140	0000		FEXT
6141	5734		JMP I SQUARE
6142	0000	EXIT6,	0
6143	5742		JMP I EXIT6

/THIS ROUTINE DOES THE SHIFTING

/MANTISSA IS ZERO

/SET ERROR FLAG





6200	0000	*6200	
6201	7300	DIV1,	0
6202	1045		CLA CLL
6203	7510		TAD HORD
6204	7120		SPA
6205	7010		CLL CML
6206	3045		RAR
6207	1046		DCA HORD
6210	7010		TAD LORD
6211	3046		RAR
6212	7100		DCA LORD
6213	2044		CLL
6214	7000		ISZ EXP
6215	5600		NOP
			JMP I DIV1
6216	0000	DMULT,	0
6217	7300		CLA CLL
6220	1312		TAD SMACLA
6221	3276		DCA SNSWIT
6222	4265		JMS SIGN
6223	1041		TAD AC1H
6224	3705		DCA I MP2PT
6225	1045		TAD HORD
6226	4704		JMS I MP4PT
6227	3046		DCA LORD
6230	1706		TAD I MP5PT
6231	3045		DCA HORD
6232	4707		JMS I NORMF
6233	3046		DCA LORD
6234	2314		ISZ SGN
6235	5616		JMP I DMULT
6236	4722		JMS I MINS
6237	5616		JMP I DMULT
6240	1041	FLDV,	TAD AC1H
6241	7650		SNA CLA
6242	5723		JMP I ERROR
6243	1040		TAD EX1
6244	7041		CMA IAC
6245	1044		TAD EXP
6246	7001		IAC
6247	3044		DCA EXP
6250	1311		TAD SPACLA
6251	3276		DCA SNSWIT
6252	4265		JMS SIGN
6253	4710		JMS I DIVIDE
6254	1706		TAD I MP5PT
6255	1041		TAD AC1H
6256	7630		SZL CLA
6257	7001		IAC
6260	3041		DCA AC1H
6261	2314		ISZ SGN
6262	4722		JMS I MINS
6263	5664		JMP I .+1
6264	5710		FLAD+2



6265	0000	SIGN,	0
6266	1315		TAD REST
6267	3314		DCA SGN
6270	1045		TAD HORD
6271	7700		SMA CLA
6272	5275		JMP •+3
6273	4722		JMS I MINS
6274	2314		ISZ SGN
6275	1041		TAD AC1H
6276	7700	SNSWIT,	SMA CLA
6277	5665		JMP I SIGN
6300	4720		JMS I MINS2
6301	2314		ISZ SGN
6302	7000		NOP
6303	5665		JMP I SIGN
6304	6427	MP4PT,	MP4
6305	6461	MP2PT,	MP2
6306	6455	MP5PT,	MP5
6307	6600	NORMF,	DNORM
6310	6462	DIVIDE,	DURDIV
6311	7710	SPACLA,	SPA CLA
6312	7700	SMACLA,	SMA CLA
6313	5601	RETURN,	FPNT+1
6314	0000	SGN,	0
6315	7776	REST,	7776
6316	0000	D,	0
6317	0000	KEEP,	0
6320	6400	MINS2,	MINUS2
6321	6413	RAR2,	DIV2
6322	6000	MINS,	ACMINS
6323	6125	ERROR,	ERROR1





PAUSE  
/NEGATE OPERAND, DOUBLE PRECISION  
\*6400

6400	0000	MINUS2,	0
6401	7300		CLA CLL
6402	1042		TAD AC1L
6403	7041		CMA IAC
6404	3042		DCA AC1L
6405	1041		TAD AC1H
6406	7040		CMA
6407	7430		SZL
6410	7101		CLL IAC
6411	3041		DCA AC1H
6412	5600		JMP I MINUS2

/SHIFT OPERAND RIGHT, DOUBLE PRECISION  
DIV2,

6413	0000	DIV2,	0
6414	7300		CLA CLL
6415	1041		TAD AC1H
6416	7510		SPA
6417	7120		CLL CML
6420	7010		RAR
6421	3041		DCA AC1H
6422	1042		TAD AC1L
6423	7010		RAR
6424	3042		DCA AC1L
6425	7100		CLL
6426	5613		JMP I DIV2

/SINGLE PRECISION MULTIPLY, 12 BY 12 BITS  
MP4,

6427	0000	MP4,	0
6430	3256		DCA MP1
6431	3255		DCA MP5
6432	1260		TAD THIR
6433	3257		DCA MP3
6434	7100		CLL
6435	1256		TAD MP1
6436	7010		RAR
6437	3256		DCA MP1
6440	1255		TAD MP5
6441	7420		SNL
6442	5245		JMP .+3
6443	7100		CLL
6444	1261		TAD MP2
6445	7010		RAR
6446	3255		DCA MP5
6447	2257		ISZ MP3
6450	5235		JMP MP4+6
6451	1256		TAD MP1
6452	7010		RAR
6453	7100		CLL
6454	5627		JMP I MP4
6455	0000	MP5,	0
6456	0000	MP1,	0
6457	0000	MP3,	0
6460	7764	THIR,	7764
6461	0000	MP2,	0





6462	0000	DUBDIV,	0
6463	7300		CLA CLL
6464	3051		DCA QUOL
6465	1316		TAD MIF
6466	3257		DCA MP3
6467	5273		JMP DVX
6470	1045	DV3,	TAD HORD
6471	7004		RAL
6472	3045		DCA HORD
6473	1045	DVX,	TAD HORD
6474	1041		TAD AC1H
6475	7420		SNL
6476	5300		JMP DV2-1
6477	3045		DCA HORD
6500	7200		CLA
6501	1051	DV2,	TAD QUOL
6502	7004		RAL
6503	3051		DCA QUOL
6504	2257		ISZ MP3
6505	5270		JMP DV3
6506	1045		TAD HORD
6507	7100		CLL
6510	7006		RTL
6511	3255		DCA MP5
6512	1051		TAD QUOL
6513	3045		DCA HORD
6514	1255		TAD MP5
6515	5662		JMP I DUBDIV
6516	7765	MIF,	7765
6517	6134	TABLE6,	SQUARE
6520	6651		SQROOT
6521	6142		EXIT6
6522	6142		EXIT6
6523	6142		EXIT6
6524	6142		EXIT6
6525	6142		EXIT6
6526	6142		EXIT6
6527	6142		EXIT6
6530	6142		EXIT6
6531	6142		EXIT6
6532	6142		EXIT6
6533	6142		EXIT6
6534	6142		EXIT6
6535	6142		EXIT6
6536	0000	DUNORM,	0
6537	4213		JMS DIV2
6540	4744		JMS I RAR1
6541	2040		ISZ EX1
6542	7000		NOP
6543	5736		JMP I DUNORM
6544	6200	RAR1,	DIV1

/ SHIFT OPERAND RIGHT



		*6600		
		/SUBROUTINE TO NORMALISE FLOATING ACC		
6600	0000	DNORM,	0	
6601	7300		CLA CLL	
6602	3250		DCA AMT1	
6603	3247		DCA SIGN1	
6604	1045		TAD HORD	
6605	7510		SPA	
6606	2247		ISZ SIGN1	/IS MANTISSA NEG
6607	7640		SZA CLA	
6610	5215		JMP GO6	/IS MANTISSA ZERO
6611	1046		TAD LORD	
6612	7640		SZA CLA	
6613	5215		JMP GO6	
6614	5244		JMP EXIT2	
6615	1247	GO6,	TAD SIGN1	
6616	7640		SZA CLA	/NEG?
6617	4646		JMS I NEG	/ YES
6620	1045	LOP,	TAD HORD	
6621	7104		RAL CLL	
6622	7710		SPA CLA	
6623	5234		JMP EXIT1	
6624	1046		TAD LORD	
6625	7004		RAL	
6626	3046		DCA LORD	
6627	1045		TAD HORD	
6630	7004		RAL	
6631	3045		DCA HORD	
6632	2250		ISZ AMT1	
6633	5220		JMP LOP	
6634	1250	EXIT1,	TAD AMT1	
6635	7041		CMA IAC	
6636	1044		TAD EXP	
6637	3044		DCA EXP	
6640	1247		TAD SIGN1	/NEG?
6641	7640		SZA CLA	
6642	4646		JMS I NEG	/YES
6643	5600		JMP I DNORM	
6644	3044	EXIT2,	DCA EXP	
6645	5600		JMP I DNORM	
6646	6000	NEG,	ACMINS	
6647	0000	SIGN1,	0	
6650	0000	AMT1,	0	





6651	0000	SQROOT,	0	
6652	3346		DCA FLAG1	/FLOATING SQUARE ROOT
6653	4407		JMS I 007	
6654	6052		FPUT FPAC1	
6655	0000		FEXT	
6656	1045		TAD HORD	
6657	7710		SPA CLA	
6660	5335		JMP SQEND1	/NUMBER IS NEGITIVE
6661	1044		TAD EXP	
6662	7100		CLL	
6663	7510		SPA	
6664	7020		CML	
6665	7010		RAR	
6666	3342		DCA ITER1	/MAKE FIRST APPROX
6667	7430		SZL	
6670	2342		ISZ ITER1	
6671	7000		NOP	
6672	1345		TAD SOCON1	
6673	3343		DCA ITER1+1	
6674	3344		DCA ITER1+2	
6675	1053		TAD FPAC1+1	
6676	7640		SZA CLA	
6677	5301		JMP CLCU	
6700	5340		JMP SQEND	/ NUMBER=0
6701	4407	CLCU,	JMS I 7	
6702	5052		FGET FPAC1	
6703	4342		FDIV ITER1	
6704	1342		FADD ITER1	
6705	0000		FEXT	
6706	7240		CLA CMA	
6707	1044		TAD EXP	
6710	3044		DCA EXP	
6711	1044		TAD EXP	
6712	7041		CMA IAC	
6713	1342		TAD ITER1	
6714	7640		SZA CLA	
6715	5331		JMP ROOTGO	
6716	1045		TAD HORD	
6717	7041		CMA IAC	
6720	1343		TAD ITER1+1	
6721	7500		SMA	
6722	7041		CMA IAC	
6723	7001		IAC	
6724	7710		SPA CLA	
6725	5331		JMP ROOTGO	
6726	1346		TAD FLAG1	
6727	3061		DCA FLAG	
6730	5651		JMP I SQROOT	





6731	4407	ROOTGO,	JMS I 7
6732	6342		FPUT ITER1
6733	0000		FEXT
6734	5301		JMP CLCU
6735	4646	SOEND1,	JMS I NEG
6736	2346		ISZ FLAG1
6737	5253		JMP SQROOT+2
6740	3044	SOEND,	DCA EXP
6741	5651		JMP I SQROOT
6742	0000	ITER1,	0
6743	0000		0
6744	0000		0
6745	3015	SQCON1,	3015
6746	0000	FLAG1,	0



ACMINS	6000
ACON6	5744
AC1H	0041
AC1L	0042
ADDR	5653
ALGN	5755
ALIGN	6013
AMOUNT	6116
AMT1	6650
CLCU	6701
D	6316
DIVIDE	6310
DIV1	6200
DIV2	6413
DMULT	6216
DNORM	6600
DONE	6073
DURDIV	6462
DUNORM	6536
DVX	6473
DV2	6501
DV3	6470
ERROR	6323
ERROR1	6125
EXIT	5726
EXIT1	6634
EXIT2	6644
EXIT6	6142
EXP	0044
EXP1	0050
EX1	0040
FLAD	5706
FLAG	0061
FLAG1	6746
FLDV	6240
FLGT	5673
FLMY	5745
FLPT	5700
FLSU	5723
FPAC1	0052
FPNT	5600
GOOF	6133
GO2	5652
GO6	6615
HORD	0045
INDRCT	5661
ITER1	6742
JUMP	5650
JUMP2	5651
KEEP	6317
LOOP01	5627
LOP	6620
LORD	0046





MASK3	5655
MASK5	5656
MASK7	5657
MIF	6516
MINS	6322
MINS2	6320
MINUS2	6400
MP1	6456
MP2	6461
MP2PT	6305
MP3	6457
MP4	6427
MP4PT	6304
MP5	6455
MP5PT	6306
MULT	5753
NEG	6646
NOGO	6104
NOHERE	6113
NORF	5757
NORM	5754
NORMF	6307
OPMINS	5725
OUTGO	6075
OVER1	0043
OVER2	0047
PAGENO	5660
QUOL	0051
RAR1	6544
RAR2	6321
REST	6315
RETN2	6124
RETURN	6313
ROOTGO	6731
SAVE	5654
SGN	6314
SHIFT	6060
SIGN	6265
SIGN1	6647
SMACLA	6312
SNSWIT	6276
SPACLA	6311
SOCON1	6745
SOEND	6740
SOEND1	6735
SOROOT	6651
SQUARE	6134
TABLE	5662
TABLE6	6517
TAG1	6122
TAG2	6123
TEST2	6117
TEST3	6120
TEST4	6121
THIR	6460
UNORM	5756





/FLOATING POINT INPUT/OUTPUT ROUTINES  
 /REQUIRES FLOATING POINT INTERPRETER  
 /ENTRY AT 0007

\*5

0005	7400		7400
0006	7200		7200
0007	5600	FPNT,	5600
		*44	
0044	0000	EXPONT,	0
0045	0000	HORDER,	0
0046	0000	LORDER,	0
		*52	
0052	0000	FPAC1,	0
0053	0000		0
0054	0000		0
0055	7777	SWIT1,	7777
0056	7777	SWIT2,	7777
0057	0000	CHAR,	0
0060	0000	DSWIT,	0
		*6767	
6767	0000	PRCHAR,	0
6770	1056		TAD SWIT2
6771	7650		SNA CLA
6772	5767		JMP I PRCHAR
6773	1377		TAD LFED
6774	4776		JMS I OPUT
6775	5767		JMP I PRCHAR
6776	7344	OPUT,	OUT
6777	0212	LFED,	0212



/DOUBLE PRECISION DECIMAL-BINARY  
/INPUT AND CONVERSION  
\*7000

7000	0000	DECONV,	0
7001	7200		CLA
7002	3045		DCA HORDER
7003	3046		DCA LORDER
7004	3265		DCA SIGN
7005	3266		DCA DNUMBR
7006	4342		JMS INPUT
7007	1336		TAD PLUS
7010	7450		SNA
7011	5217		JMP DECON
7012	1335		TAD MINUS
7013	7440		SZA
7014	5220		JMP .+4
7015	7240		CLA CMA
7016	3265		DCA SIGN
7017	4342	DECON,	JMS INPUT
7020	7200		CLA
7021	1057		TAD CHAR
7022	1337		TAD MIN9
7023	7500		SMA
7024	5600		JMP I DECONV
7025	1340		TAD PLUS12
7026	7510		SPA
7027	5600		JMP I DECONV
7030	3263		DCA DIGIT
7031	1045		TAD HORDER
7032	0341		AND MASK
7033	7440		SZA
7034	5217		JMP DECON
7035	2060		ISZ DSWIT
7036	2266		ISZ DNUMBR
7037	4241		JMS MULT10
7040	5217		JMP DECON
7041	0000	MULT10,	0
7042	1046		TAD LORDER
7043	3261		DCA LTEMP
7044	1045		TAD HORDER
7045	3262		DCA HTEMP
7046	3264		DCA REMAIN
7047	4267		JMS MULT2
7050	4267		JMS MULT2
7051	4303		JMS DUBLAD
7052	4267		JMS MULT2
7053	1263		TAD DIGIT
7054	3261		DCA LTEMP
7055	3262		DCA HTEMP
7056	4303		JMS DUBLAD
7057	1264		TAD REMAIN
7060	5641		JMP I MULT10
7061	0000	LTEMP,	0
7062	0000	HTEMP,	0
7063	0000	DIGIT,	0
7064	0000	REMAIN,	0
7065	0000	SIGN,	0
7066	0000	DNUMBR,	0





7067	0000	MULT2,	0
7070	7300		CLA CLL
7071	1046		TAD LORDER
7072	7004		RAL
7073	3046		DCA LORDER
7074	1045		TAD HORDER
7075	7004		RAL
7076	3045		DCA HORDER
7077	1264		TAD REMAIN
7100	7004		RAL
7101	3264		DCA REMAIN
7102	5667		JMP I MULT2
7103	0000	DUBLAD,	0
7104	7300		CLA CLL
7105	1046		TAD LORDER
7106	1261		TAD LTEMP
7107	3046		DCA LORDER
7110	7004		RAL
7111	1045		TAD HORDER
7112	1262		TAD HTEMP
7113	3045		DCA HORDER
7114	7004		RAL
7115	1264		TAD REMAIN
7116	3264		DCA REMAIN
7117	5703		JMP I DURLAD
7120	0000	MSIGN,	0
7121	7300		CLA CLL
7122	2265		ISZ SIGN
7123	5720		JMP I MSIGN
7124	1046		TAD LORDER
7125	7041		CMA IAC
7126	3046		DCA LORDER
7127	1045		TAD HORDER
7130	7040		CMA
7131	7430		SZL
7132	7001		IAC
7133	3045		DCA HORDER
7134	5720		JMP I MSIGN
7135	7776	MINUS,	-2
7136	7525	PLUS,	-253
7137	7506	MIN9,	-272
7140	0012	PLUS12,	12
7141	7600	MASK,	7600





/INPUT A CHARACTER, IF CR, TEST  
 /INPUT SWITCH TO SEE IF LF SHOULD  
 /BE TYPED. IF RUBOUT, RESTART INPUT.

7142	0000	INPUT,	0
7143	7200		CLA
7144	6031		KSF
7145	5344		JMP --1
7146	6036		KRB
7147	3057		DCA CHAR
7150	1057		TAD CHAR
7151	4766		JMS I OUTPUT
7152	1057		TAD CHAR
7153	7450		SNA
7154	5343		JMP INPUT+1
7155	1370		TAD MRBOUT
7156	7450		SNA
7157	5767		JMP I RESTRT
7160	1371		TAD MINCR
7161	7650		SNA CLA
7162	4765		JMS I PRINT
7163	1057		TAD CHAR
7164	5742		JMP I INPUT
7165	6767	PRINT,	PRCHAR
7166	7344	OUTPUT,	OUT
7167	7401	RESTRT,	FLINTP+1
7170	7401	MRBOUT,	-377
7171	0162	MINCR,	377-215
7172	7300	ROU,	CLA CLL
7173	1046		TAD LORDER
7174	7710		SPA CLA
7175	2045		ISZ HORDER
7176	5777		JMP I .+1
7177	7575		LFLINT



/FLOATING OUTPUT "E" FORMAT

/USES: TSF  
/ JMP --1  
/ TLS

\*7200

7200	0000	FLOUTP,	0
7201	4217		JMS FOUTCN
7202	1324		TAD BEXP
7203	3044		DCA EXPONT
7204	1343		TAD CHE
7205	4344		JMS OUT
7206	4737		JMS I FEXPPT
7207	1055		TAD SWIT1
7210	7650		SNA CLA
7211	5600		JMP I FLOUTP
7212	1341		TAD CARRTN
7213	4344		JMS OUT
7214	1342		TAD LNFEED
7215	4344		JMS OUT
7216	5600		JMP I FLOUTP

/THIS WHOLE SUBROUTINE MAY BE ALTERED TO BUFFER  
/TE OUTPUT DIGITS: CHANGE JMS OUTDG TO DCA I 10

7217	0000	FOUTCN,	0
7220	7300		CLA CLL
7221	1045		TAD HORDER
7222	7710		SPA CLA
7223	7220		CLA CML
7224	1327		TAD SPLUS
7225	7430		SZL
7226	1330		TAD SMINUS
7227	4344		JMS OUT
7230	4352		JMS OUTDG
7231	1331		TAD PERIOD
7232	4344		JMS OUT
7233	7300		CLA CLL
7234	1045		TAD HORDER
7235	7700		SMA CLA
7236	5242		JMP FGO1
7237	7040		CMA
7240	3733		DCA I SNPT
7241	4732		JMS I MSNPT
7242	7240	FGO1,	CLA CMA
7243	1044		TAD EXPONT
7244	3044		DCA EXPONT
7245	3324		DCA BEXP
7246	1044	FGO2,	TAD EXPONT
7247	7500		SMA
7250	5263		JMP FGO3
7251	1326		TAD FOUR
7252	7700		SMA CLA
7253	5270		JMP FGO4
7254	4407		JMS I FPNT
7255	3740		FMPY I TENPT
7256	0000		FEXT
7257	7240		CLA CMA
7260	1324		TAD BEXP
7261	3324		DCA BEXP
7262	5246		JMP FGO2





1200	4401	FG03,	JMS I FPNT
7264	3372		FMPY TENTH
7265	0000		FEXT
7266	2324		ISZ REXP
7267	5246		JMP FG02
7270	3734	FG04,	DCA I DPT
7271	4736		JMS I M2PT
7272	4735		JMS I M10PT
7273	7410		SKP
7274	4357	FG05A,	JMS DIVTWO
7275	2044		ISZ EXPONT
7276	5274		JMP FG05A
7277	7450		SNA
7300	5311		JMP FG07
7301	4352	FG06,	JMS OUTDG
7302	1325		TAD MINUS7
7303	3044		DCA EXPONT
7304	4735	FG06A,	JMS I M10PT
7305	4352		JMS OUTDG
7306	2044		ISZ EXPONT
7307	5304		JMP FG06A
7310	5617		JMP I FOUTCN
7311	7240	FG07,	CLA CMA
7312	1324		TAD BEXP
7313	3324		DCA BEXP
7314	1045		TAD HORDER
7315	7640		SZA CLA
7316	5322		JMP .+4
7317	1046		TAD LORDER
7320	7650		SNA CLA
7321	3324		DCA BEXP
7322	7240		CLA CMA
7323	5302		JMP FG06+1
7324	0000	BEXP,	0
7325	7774	MINUS7,	7774
7326	0004	FOUR,	4
7327	0253	SPLUS,	253
7330	0002	SMINUS,	2
7331	0256	PERIOD,	256
7332	7120	MSNPT,	MSIGN
7333	7065	SNPT,	SIGN
7334	7063	DPT,	DIGIT
7335	7041	M10PT,	MULT10
7336	7067	M2PT,	MULT2
7337	7522	FEXPPT,	FEXC
7340	7504	TENPT,	TEN
7341	0215	CARRTN,	215
7342	0212	LNFEED,	212
7343	0305	CHE,	305
7344	0000	OUT,	0
7345	6041		TSF
7346	5345		JMP .-1
7347	6046		TLS
7350	7200		CLA
7351	5744		JMP I OUT
7352	0000	OUTDG,	0
7353	1356		TAD C260
7354	4344		JMS OUT
7355	5752		JMP I OUTDG
7356	0260	C260,	260





7357	0000	DIVTWO,	0
7360	7110		CLL RAR
7361	3344		DCA OUT
7362	1045		TAD HORDER
7363	7010		RAR
7364	3045		DCA HORDER
7365	1046		TAD LORDER
7366	7010		RAR
7367	3046		DCA LORDER
7370	1344		TAD OUT
7371	5757		JMP I DIVTWO

7372	7775	TENTH,	7775
7373	3147		3147
7374	0000		0000

/FLOATING POINT INPUT  
\*7400

7400	0000	FLINTP,	0
7401	7240		CLA CMA
7402	3313		DCA PRSW
7403	3060		DCA DSWIT
7404	4716		JMS I DPCVPT
7405	7200		CLA
7406	1057		TAD CHAR
7407	1312		TAD PER
7410	7640		SZA CLA
7411	5220		JMP FIG01
7412	1313		TAD PRSW
7413	7650		SNA CLA
7414	5222		JMP FIG02
7415	3721		DCA I DPN
7416	3313		DCA PRSW
7417	5717		JMP I DPCSPT

7420	1313	FIG01,	TAD PRSW
7421	7650		SVA CLA
7422	1721	FIG02,	TAD I DPN
7423	7041		CMA IAC
7424	3314		DCA SEXP
7425	4720		JMS I MSGNPT
7426	1311	FIG03,	TAD C27
7427	3044		DCA EXPONT
7430	4777		JMS I XNORM
7431	4407		JMS I FPNT
7432	6052		FPUT FPAC1
7433	0000		FEXT
7434	1057		TAD CHAR
7435	1310		TAD MINUSE
7436	7640		SZA CLA
7437	5252		JMP ENDF1
7440	4716		JMS I DPCVPT
7441	4720		JMS I MSGNPT
7442	1045		TAD HORDER
7443	7510		SPA
7444	7001		IAC
7445	7640		SZA CLA
7446	5277		JMP EXCESS
7447	1046		TAD LORDER
7450	1314		TAD SEXP
7451	3314		DCA SEXP



/END OF FLOATING POINT INPUT  
/COMPENSATE FOR DECIMAL EXPONENTS

7452	4407	ENDF1,	JMS I FPNT
7453	5052		FGET FPAC1
7454	0000		FEXT
7455	1314		TAD SEXP
7456	7450		SNA
7457	5776		JMP I LROU
7460	7700		SMA CLA
7461	5270		JMP FIG04
7462	4407		JMS I FPNT
7463	3707		FMPY I TENTHL
7464	0000		FEXT
7465	2314		ISZ SEXP
7466	5255		JMP ENDF1+3
7467	5776		JMP I LROU

7470	4407	FIG04,	JMS I FPNT
7471	3304		FMPY TEN
7472	0000		FEXT
7473	7240		CLA CMA
7474	1314		TAD SEXP
7475	3314		DCA SEXP
7476	5255		JMP ENDF1+3

7477	1315	EXCESS,	TAD C3777
7500	3044		DCA EXPONT
7501	1315		TAD C3777
7502	3045		DCA HORDER
7503	5776		JMP I LROU

7504	0004	TEN,	0004
7505	2400		2400
7506	0000		0000
7507	7372	TENTHL,	TENTH
7510	7473	MINUSE,	-305
7511	0027	C27,	0027
7512	7522	PER,	-256
7513	0000	PRSW,	0
7514	0000	SEXP,	0
7515	3777	C3777,	3777

7516	7000	DPCVPT,	DECONV
7517	7017	DPCSPT,	DECON
7520	7120	MSGNPT,	MSIGN
7521	7066	DPN,	DNUMBR





OUTPUT THE EXPONENT  
FEXC,

7522	0000	
7523	7300	
7524	1044	CLA CLL
7525	7510	TAD EXPONT
7526	7061	SPA
7527	3044	CMA IAC CML
7530	1366	DCA EXPONT
7531	7430	TAD C253
7532	1367	SZL
7533	4774	TAD C255
7534	3045	JMS I DGPT
7535	1044	DCA HORDER
7536	2045	TAD EXPONT
7537	1370	ISZ HORDER
7540	7500	TAD M144
7541	5336	SMA
7542	1371	JMP --3
7543	3044	TAD C144
7544	7040	DCA EXPONT
7545	1045	CMA
7546	7440	TAD HORDER
7547	4774	SZA
7550	3045	JMS I DGPT
7551	1044	DCA HORDER
7552	2045	TAD EXPONT
7553	1372	ISZ HORDER
7554	7500	TAD M12
7555	5352	SMA
7556	1373	JMP --3
7557	3046	TAD C12
7560	7240	DCA LORDER
7561	1045	CLA CMA
7562	4774	TAD HORDER
7563	1046	JMS I DGPT
7564	4774	TAD LORDER
7565	5722	JMS I DGPT
		JMP I FEXC
7566	7773	C253,
7567	0002	C255,
7570	7634	M144,
7571	0144	C144,
7572	7766	M12,
7573	0012	C12,
7574	7352	DGPT,
7575	5600	LFLINT,
7576	7172	LROU,
		*7577
7577	6600	XNORM,
		253-260
		255-253
		7634
		0144
		7766
		0012
		OUTDG
		JMP I FLINTP
		ROU
		6600





BEXP	7324
CARRTN	7341
CHAR	0057
CHE	7343
C12	7573
C144	7571
C253	7566
C255	7567
C260	7356
C27	7511
C3777	7515
DECON	7017
DECONV	7000
DGPT	7574
DIGIT	7063
DIVTWO	7357
DNUMBR	7066
DPCSPT	7517
DPCVPT	7516
DPN	7521
DPT	7334
DSWIT	0060
DURLAD	7103
ENDF1	7452
EXCESS	7477
EXPONT	0044
FEXC	7522
FEXPPT	7337
FG01	7242
FG02	7246
FG03	7263
FG04	7270
FG05A	7274
FG06	7301
FG06A	7304
FG07	7311
FIG01	7420
FIG02	7422
FIG03	7426
FIG04	7470
FLINTP	7400
FLOUTP	7200
FOUR	7326
FOUTCN	7217
FPAC1	0052
FPNT	0007
HORDER	0045
HTEMP	7062
INPUT	7142



LFED	6777
LFLINT	7575
LNFEED	7342
LORDER	0046
LROU	7576
LTEMP	7061
MASK	7141
MINCR	7171
MINUS	7135
MINUSE	7510
MINUS7	7325
MIN9	7137
MRBOUT	7170
MSGNPT	7520
MSIGN	7120
MSNPT	7332
MULT10	7041
MULT2	7067
M10PT	7335
M12	7572
M144	7570
M2PT	7336
OPUT	6776
OUT	7344
OUTDG	7352
OUTPUT	7166
PER	7512
PERIOD	7331
PLUS	7136
PLUS12	7140
PRCHAR	6767
PRINT	7165
PRSW	7513
REMAIN	7064
RESTRT	7167
ROU	7172
SEXP	7514
SIGN	7065
SMINUS	7330
SNPT	7333
SPLUS	7327
SWIT1	0055
SWIT2	0056
TEN	7504
TENPT	7340
TENTH	7372
TENTHL	7507
XNORM	7577



